SKLEAREVICI, I.A. [Shklyarevich, I.A.]

Application of high vacuum for the intensification of
agglomeration process. Analele metalurgie 16 no.3:15-18 Jl-S
'62.

SHKLYAREVICH, I.A.

"Equipment of sintering plants for ferrous metallurgy" by A.E.Seleznev.
Reviewed by I.A. Shkliarevich. Stal' 22 no.10:889-890 0'62.

(MIRA15:10)

1. Vsesoyuznyy nauchno-issledovatel'skiy i proyektnyy institut
mekhanicheskoy obrabotki poleznykh iskopayemykh.

(Sintering--Equipment and supplies)
(Selezne, A.E.)

SHKLYAREVICH, I.A.

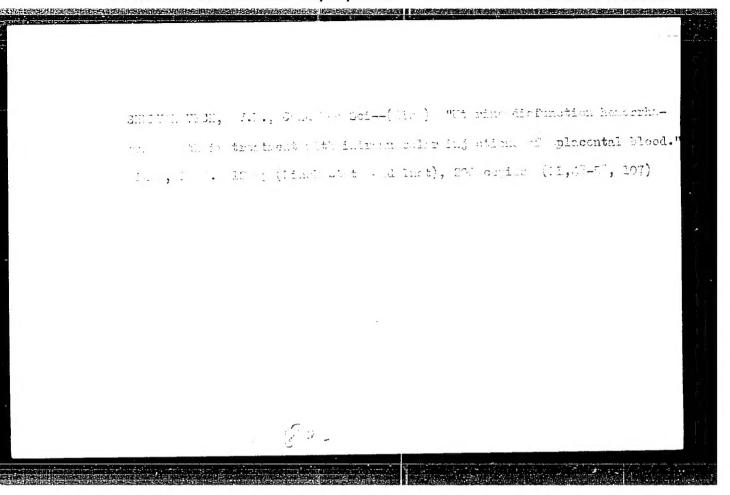Intensifying the sintering process. Met. i gornorud. prom. no.2:
16-18 Mr-Ap '65.   (MIRA 18:5)

SHKLYAREVSKIY, I.N.; MILOSLAVSKIY, V.K.; GOLOYADOVA, V.I.

Wide-aperture interference of light. Opt. i spektr. 17 no.5:
765-770 N '64.   (MIRA 17:12)

SMIRNOV, V.M., A.I., ... ged--(...) "... ... dysfunction hemorrhi-
... ... this treatment with intra ... subcutaneous injection of placental blood."
... ... 10 .; (Pienk sbst ... ind Inst), SSR series (... 1, ... -..., 107)

SHKLYAREVICH, V.M., assistent

Malignant theco-folliculoma. Zdrav.Belor. 4 no.3:63 Mr '58.
(MIRA 13:7)

1. Iz akushersko-ginekologicheskoy kliniki (zaveduyushchiy
kafedroy – dotsent I.S. Legenchenko) Minskogo instituta uso-
vershenstvovaniya vrachey.
(GENERATIVE ORGANS, FEMALE--TUMORS)

BODULIN, V.P., prof.; SHKLYAREVSKAYA, Ye.V., kand. med. nauk; YEROMYSH'YAN, G.A., student.

Topical diagnosis of pulmonary echinococcosis. Uch. zap. Stavr. gos. med. inst. 8:177-187 '63   (MIRA 17:7)

1. Kafedra obshchey khirurgii (zav. - prof. V.P. Bodulin) Stavropol'skogo meditsinskogo instituta (rektor zasluzhennyy deyatel' nauki, prof. V.G. Budylin).

PA 227746

SHKLYAREVSKIY, A. I.

USSR/Geophysics - Irrigation   Jun 52
Specialists

"Chronicles: Conference on the Problem Con-
cerning Methods for Irrigation of Agricul-
tural Cultivation," A.I. Shklyarevskiy

"Gidrotekh 1 Melio" No 6, pp 75-80.

During 12 - 14 Mar 52, in Moscow, the Hydro-
technics and Amelioration Sec of the All-Union
Acad of Agri Sci imeni Lenin held a plenum,
with participation of agricultural and hydro-
logical administrators, directors, and main
agronomists of MTS (machine-tractor stations),

besides presidents of kolkhozs in irrigated
districts of Kuybyshev and Saratov Oblasts.
Discussed were problems of utilizing irri-
gated lands under conditions met beyond the
Volga and in other new regions being irrigated.
Reports were heard from 22 lecturers: I.A.
Minkevich, substitute for Minister of Agri
USSR; Prof V.A. Shaumyan, substitute for the
director of scientific part of All-Union Sci
Res Inst of Hydrotechnics and Amelioration;
I.P. Kuryley, head, Kuybyshev Oblast Water
Econ; I.A. Isakov, Chief Agronomist, Georgiyev
MTS; Dorokhin, Pres, "Krasnaya Znamya" Kolkhoz;
Kharitonov, Chief Agronomist, Saratov Oblast
Land Admin; Prokhorov, Chief Agronomist, Saratov
Oblast MTS; Pakhomov, pres, "Komsomolets"
Kolkhoz; Yershov, Pres, Kuybyshev Oblast Exec
Committee; Ye.G. Petrov, Cand Agr Sci, All-Union
Sci Res Inst of Hydrotechnics and Amelioration;
Yegorshilov, Engr; N.P. Samsonov, Sr Sci Assoc,
All-Union Sci Res Inst of Hydrotechnics, and
Amelioration; Nesterov, Pres, "Zarya" Kolkhoz;
V.G. Kornev; Ostovskiy, Sr Sci Assoc of
Ukrainian Exptl Sta; etc.

227746

ASTAPOV, Sergey Vasil'yevich, professor; SPENGLER, Valentina Vasil'yevna; SHKLYAREVSKIY, A.I., redaktor; PERESYPKINA, Z.D., tekhnicheskiy redaktor; ARISTAKESOVA, S.L., tekhnicheskiy redaktor

[Prevention and control of salinity and sqamping in irrigated lands] Preduprezhdenie i bor'ba s zasoleniem i zabolachivaniem oroshaemykh zemel'. Moskva, Gos. izd-vo selkhoz. lit-ry, 1956. 158 p. (MLRA 9:12)
(Salinity)   (Swamps)

SHKLYAREVSKIY, A.I.

OFFENGENDEN, Samuil Rafailovich,kandidat tekhnicheskikh nauk; PANADIADI,
A.D., kandidat sel'skokhozyaystvennykh nauk; TROMBACHEV, S.P.,inzhener,
[deceased]; YARUSHIN, M.I., inzhener; KREMENETSKIY , N.D.kandidat
sel'skokhozyaystvennykh nauk; KAGAN, G.S., inzhener; NIKOLAYEV,I.G.,
inzhener; TRUBACHEVA, Ye.G., kul'turtekhnik; SHKLYAREVSKIY, A.I.,
redaktor; FEDOTOVA, A.F., tekhnicheskiy redaktor.

[Operation of irrigation and drainage systems] Ekspluatatsiia gidro-
meliorativnykh sistem. Pod red.S.R. Offengendena. Moskva, Gos.izd-
vo sel'khoz.lit-ry, 1956. 535 p.   (MLRA 10:6)
        (Irrigation)   (Drainage)

AUTHOR: Shklyarevskiy, A.I., Engineer   SOV/99-59-1-8/13

TITLE: The Kotaykskaya Irrigation System is in Operation (Kotaykskaya skaya orositel'naya sistema vstupila v stroy deystvuyushchikh)

PERIODICAL: Gidrotekhnika i melioratsiya, 1959, Nr 1, pp 33-37 (USSR)

ABSTRACT: The author describes how, under very difficult conditions, Armenian workers in a short time built the Kotaykskaya irrigation system. This system will irrigate 7,500 hectares, serviced by 116 km of permanent canals. A total of 23,000 cu m of concrete and 700 tons of metal structure were used in the construction. In November 1958, the Arzni-Shamiramskaya irrigation system with a 17 km long canal was put into operation. There are 8 photographs.

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SOV/99-59-3-10/10

30(1)

AUTHORS: Lapidovskiy, K.M., and Shklyarevskiy, A.I., Engineers

TITLE: In the Scientific and Technical Council of the Ministry
             of Agriculture of the USSR (V nauchno-tekhnicheskom
             sovete ministerstva sel'skogo khozyaystva SSSR)

PERIODICAL: Gidrotekhnika i melioratsiya, 1959, Nr 3, pp 60-64
             (USSR)

ABSTRACT: The article is concerned with a meeting of the Scien-
             tific and Technical Council of the Ministry of Agri-
             culture of the USSR held during the period 12 - 15
             January 1959, and devoted to full mechanization of
             cotton cultivation and harvesting. The meeting was
             attended by specialists in cotton growing of Uzbe-
             kistan, Turkmeniya, Azerbaydzhan, Kazakhstan, and
             Tadzhikistan, by research workers of the cotton-produ-
             cing republics, by representatives of the plants
             making cotton-tilling machinery, by scientific workers
             of the Vsesoyuznaya akademiya sel'skokhozyaystvennykh
Card 1/5   nauk imeni Lenina (All-Union Academy of Agricultural

SOV/99-59-3-10/10

In the Scientific and Technical Council of the Ministry of Agriculture of the USSR

Sciences imeni Lenin), and by specialists of the organizations affiliated with water economy, hydraulic engineering, etc. The meeting was also attended by representatives of the Gosudarstvennyy nauchno-tekhnicheskiy komitet Soveta Ministrov SSSR (State Scientific and Technical Committee of the Ministers' Council of the USSR), those of the Uzbek and Kirgiz SSR; the Gosplan USSR, the Ministerstvo sel'skogo khozyaystva SSSR (Ministry of Agriculture of the USSR), and the ministries of agriculture and water economy of the cotton-producing republics. The meeting was opened by G.A. Borkov, Deputy Minister of Agriculture of the USSR, whose short speech was followed by reports made by the following personalities: 1) T.G. Zinin, Deputy Director of the Uzbekskiy nauchno-issledovatel'skiy institut mekhanizatsii i elektrifikatsii sel'skogo khozyaystva (Uzbek Research Institute for the Mechanization and Electrification of Agriculture); 2) V.A. Tyupko, of the Sredneaziatskaya MIS (Central Asian

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SOV/99-59-3-10/10

In the Scientific and Technical Council of the Ministry of Agriculture of the USSR

MIS); 3) M.Ya. Topada, Chief Engineer of the Pakhta-Aral sovkhoz; 4) N. Bekirov, of the "Bayaut Nr 4" sovkhoz, Tashkent oblast ; 5) I.I. Meleshko , Director of the Sredneaziatskaya mashino-ispytatel'naya stantsiya (Central Asian Machine Testing Station); 6) B.Ye. Arkhangel'skiy, Chief Designer of the Lipetskiy traktornyy zavod (Lipetsk Tractor Plant); 7) Ye.A. Sarkisyants, Chief Designer of the Vladimirskiy traktornyy zavod (Vladmimir Tractor Plant); 8) N.I. Popov, Chief Specialist of the Nauchno-tekhnicheskiy komitet Soveta ministrov Uzbekskoy SSR (Scientific and Technical Committee of the Ministers' Council of the Uzbek SSR); 9) Ye.V. Radkevich, Chief Designer of the SKB for Cotton of the Tashkent Sovnarkhoz); 10) B.P. Firsov, Deputy Chief Inspector for Cotton of the MSKh SSSR; 11) A.N. Askochenskiy, Academician and Secretary of the Otdeleniye gidrotekhniki i melioratsii VASKhNIL (Hydraulic Engineering and Melioration Department of VASKhNIL); 12) K.K. Shub-

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SOV/99-59-3-10/10

In the Scientific and Technical Council of the Ministry of Agriculture of the USSR

ladze, Deputy Chief of Glavvodkhoz MSKh USSR; 13) N.N. Bukov, Senior Scientific Worker of VNIIGiM; 14) L.D. Stonov, NIUIF; 15) M.F. Kulikov, Ferganskaya opytnaya stantsiya (Fergana Testing Station); 16) S.D. Robichev, Gosplan SSSR; 17) N.I. Fershtat, Deputy Minister of Agriculture of the Uzbek SSR; 18) A.A. Troitskiy, Deputy Minister of Agriculture of the Tadzhik SSR, 19) M.A. Matveyev, GosNIIGVF; 20) N.I. Kostyuk, MSKh of the Kirgiz SSR; 21) S.M. Shakhmuryadyan, VIM; 22) M. Khalilov, MSKh of the Azerbaydzhan SSR; 23) K.A. Gularyan, ArmNIIZ; 24) A.A. Karimov, GNTK of the Sovet Ministrov Uzbekskoy SSR (Ministers Council of the Uzbek SSR); 25) N.I. Depta, Tashkent sovnarkhoz; 26) M.N. Anan'yev, Giprovodkhoz; 27) I.P. Panov, Tashsel'mash; 28) Ivanov, GOSNITI; and 29) V.A. Kaufman, Glavnoye upravleniye mekhanizatsii i elektrofikatsii MSKh SSSR (Central Administration of the Mechanization and Electrofication of the MSKh USSR). Among the organizations only

Card 4/5

SOV/99-59-3-10/10

In the Scientific and Technical Council of the Ministry of Agriculture of the USSR

mentioned in the above reports yet not listed above are the following: 1) Vsesoyuznyy nauchno-issledovatel'skiy institut gidrotekhniki i melioratsii imeni A.N. Kostyakova (All-Union Research Institute of Hydraulic Engineering and Melioration imeni A.N. Kostyakov); 2) Gidroproyekt; and 3) VNIIStroydormash.

Card 5/5

SHKLYAREVSKIY, A.I., inzh.

Kotaiksk irrigation system went into operation. Gidr. i mel. 11 no.1:33-37 Ja '59.   (MIRA 12:1)

(Armenia--Irrigation)

SHKLYAREVSKIY, A.I.

Plenum of the Section for Hydraulic Engineering and Soil Improvement at ehe Lenin All-Union Academy of Agrucultural Sciences.
Gidr. i mel. 14 no.4:57-63 Ap '62.   (MIRA 15:5)
(Irrigation) (Drainage)

BODULIN, V.P., prof.; SHKLYAREVSKAYA, Ye.V., kand. med. nauk

Topical diagnosis of hydatids of the lungs. Uch. zap. Stavr.
gos. med. inst. 12:205 '63.   (MIRA 17:9)

1. Kafedra obshchey khirurgii (zav. prof. Yu.S. Gilevich)
Stavropol'skogo gosudarstvennogo meditsinskogo instituta.

24(5),21(7)
AUTHOR: Shklyarevskiy, G. M.   SOV/56-36-5-29/76

TITLE: Single-Particle Mechanism in Photonuclear Reactions
                 (Odnochastichnyy mekhanizm v fotoyadernykh reaktsiyakh)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959,
                 Vol 36, Nr 5, pp 1492-1496 (USSR)

ABSTRACT: In the introduction the problem as well as a number of earlier
                 papers are discussed in short. It is pointed out that there
                 exist experimental facts which do not fit into the framework
                 of the two-particle model (the existence of photoprotons with
                 energies that are nearly equal to the maximum energy in the
                 γ-spectrum, shifting of the maximum of angular distribution
                 towards the angular range of 20-50°, and direct observation of
                 (γp)- and (γn)-reactions at high photon energies). Therefore,
                 the direct single-particle mechanism, especially in the range
                 of gigantic resonance, is of great interest. To investigate it
                 for nuclear photo-reactions at high energies of the emitted
                 nucleons ($\gtrsim$20 Mev) on the basis of the shell model is the aim
                 to be achieved by the present paper. Satisfying the momentum
                 conservation law warrants also consideration of the momentum of
Card 1/3   the nucleon bound in the nucleus, and, at the same time,

Single-Particle Mechanism in Photonuclear Reactions   SOV/56-36-5-29/76

makes it possible to explain the forward shift of the angular distribution like in the case of the atomic photoeffect. The author bases upon the following assumptions: The nucleus in the ground state is assumed to consist of nucleons moving independently in a centrally-symmetric potential field; the state of each nucleon is assumed to be characterized by the orbital momentum l, its projection m, and the binding energy ϵ_1 .

Spin and magnetic moment of the nucleon are neglected, which amounts to a neglect of spin-orbit splitting. In consequence of the neglect of nucleon interaction, only "hole" excitations of the residual nucleus are possible; the energy of these excitations is contained in the binding energy of the nucleon. The description of the interactions in the final state is carried out by means of the optical nuclear model. Calculations are carried out in momentum approximation. Basing on the operator of the interaction between nucleus and electromagnetic field, expressions are derived for the matrix element M

in the reaction cross section formula $d\sigma = \frac{2\pi}{\hbar} |M|^2 \rho(E)$.

Card 2/3   Theoretical and experimental results are compared.

Single-Particle Mechanism in Photonuclear Reactions   SOV/56-36-5-29/76

It is shown that interaction in the final state can be described by the optical model and that 2 effects, above all, occur: 1.) The existence of an imaginary part in the potential leads to a reduction of the cross section of the direct photo process at the expense of the development of intranuclear cascades and (or) the occurrence of excited states of the type of a compound nucleus. 2.) The nucleon after photon absorption is elastically scattered on the real part of the potential, which leads to a certain "smearing-out" of the angular distribution. The author finally thanks Professor L. A. Sliv and Professor I. M. Shmushkevich for their valuable comments. There are 1 figure and 13 references, 2 of which are Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk SSSR
(Physico-Technical Institute of the Academy of Sciences, USSR)

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84407

24.6520

AUTHOR: Shklyarevskiy, G. M.

TITLE: Theory of Photonuclear Reactions of Light Nuclei With Emission of Deuterons

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 4(10), pp. 1031 - 1038

TEXT: In the present paper, the author gives a theory of the γd-reaction of light nuclei within the framework of the independent-pair model in small-correlator approximation. This model takes into account both the general self-consistent field and the pair interaction leading to nucleonic motion correlations. The wave function in this model is formulated as follows: $\Psi = |\psi_{\alpha_1}(1)\psi_{\alpha_2}(2)\ldots\psi_{\alpha_n}(n)|(1+\sum\chi_{ij})$, where

ψ_{α_i} ($i=1,2\ldots n$) is the single-particle wave function, and χ_{ij} the correlators. At distance of the order of the mean nucleon distances in the nucleus, $\chi_{ij}\ll 1$ holds in the approximation used. The mechanism of

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Theory of Photonuclear Reactions of Light   S/056/60/039/004/025/048
Nuclei With Emission of Deuterons   B006/B063

excitation of the product nucleus as a result of quick variation of the
self-consistent field of the nucleus during emission of a pair of
nucleons is considered, and the excitation probability in the region of
the continuous spectrum is calculated for the case of independent
particles. It is shown that correct values for the γd cross sections of
light nuclei and also for the shapes of energy spectra and angular
distributions can be obtained by employing published values of the para-
meters involved in the theory. The results obtained are compared with
experimental data on C^{12} and Be^9 nuclei. Data on the $\sigma_{\gamma d}/\sigma_{\gamma p}$ ratio were
given by V. P. Chizhov and L. A. Kul'chitskiy. The experimental data are
graphically compared with various theoretical curves. Fig. 1 shows
$d\sigma/d\Omega = f(E_d)$ calculated for transitions without a change of the nuclear
configuration (Curve 1), for transitions taking account of single-particle
excitations (Curve 2) and two-particle excitations (Curve 3) for C^{12} with
$\hbar\omega(C^{12}) = 15.2$ Mev, $\hbar\omega(B^{10}) = 17.0$ Mev, and $E_{\gamma max} = 80$ Mev; Fig. 2 shows
the same for Be^9 with $\hbar\omega(Be^9) = 16.2$ Mev, $\hbar\omega(Li^7) = 18.9$ Mev, and

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Theory of Photonuclear Reactions of Light   S/056/60/039/004/025/048
Nuclei With Emission of Deuterons   B006/B063

$E_{\gamma max}$ = 90 Mev. Fig. 3 shows a comparison between the experimental and
theoretical angular distributions of the reactions $C^{12}(\gamma d)$ and $Be^9(\gamma d)$
normalized for $\theta = 60^{\circ}$. $R = 1.5A^{1/3}.10^{-13}$ cm was assumed for all the
calculations. The author thanks S. V. Maleyev, A. D. Piliya, and Professor
L. A. Sliv for discussions and comments, and also V. P. Chizhov for a
discussion of experimental data. Migdal, L. E. Pargamanik, and
V. V. Ul'yanov are mentioned. There are 3 figures and 16 references:
4 Soviet, 6 US, 2 British, 1 Swiss, and 3 German.

ASSOCIATION: Leningradskiy fiziko-tekhnicheskiy institut Akademii nauk
               SSSR (Leningrad Institute of Physics and Technology of the
               Academy of Sciences, USSR)

SUBMITTED: April 30, 1960

Card 3/3

SHKLYAREVSKIY, G.M.

Nucleon correlations and photonuclear reactions. Part 1: Photo-
disintegration of He4. Zhur.eksp.i teor.fiz. 41 no.1:234-238 J1
'61.
(MIRA 14:7)

1. Leningradskiy fiziko-tekhnicheskiy institut AN SSSR.
   (Photonuclear reactions) (Nucleons)   (Helium—Isotopes)

SHKLYAREVSKIY, G.M.

SHKLY-AREVSKIY, G. M.

Dissertation defended for the degree of <u>Candidate of Physicomathematical Sciences</u> at the Physics imeni P. N. Lebedev in 1962:

"Correlations of Nucleons, and Simple Photonuclear Reactions."

Vest. Akad. Nauk SSSR.   No. 4, Moscow, 1963, pages 119-145

ACCESSION NR: AP4019238

S/0056/64/046/002/0690/0694

AUTHOR: Shklyarevskiy, G. M.

TITLE: Inelastic scattering of photons by a Coulomb field accompanied by electron-positron pair production

SOURCE: Zhurnal eksper. i teor. fiz., v. 46, no. 2, 1964, 690-694

TOPIC TAGS: Compton effect, inelastic photon scattering, scattering by Coulomb field, electron positron pair production, Weizsacker-Williams method, proton polarizability, proton polarizability correction

ABSTRACT: In this investigation the energies of the incident photons are assumed much larger than the electron mass and the energy losses are assumed to be small. The analysis of the scattering is by the Weizsacker-Williams method in its invariant formulation given by Gribov et al. (ZhETF v. 41, 1839, 1961). This scattering process

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ACCESSION NR: AP4019238

has not been treated in the literature before. It is shown that
this process occurs in a lower order of perturbation theory than
other processes involving the Compton effect on protons or other
nuclei, and that at small angles it appreciably exceeds the correc-
tion to the Compton effect on a proton due to the polarizability
of the nucleus. Furthermore, it exerts a decisive effect on the
background which interferes with the measurement of the Compton-
effect cross section in the small-angle region. The results are
compared with some experimental data. The cross section of the dis-
integration of a photon into two photons by interaction with the
Coulomb field of the proton is two orders of magnitude smaller at
all angles (except the largest ones) than the cross section of the
investigated process. "I am grateful to I. M. Shmushkevich and
V. M. Shekhter for a discussion of the work and for critical re-
marks." Orig. art. has: 17 formulas, 1 figure, and 1 table.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR

Card   2/3

ACCESSION NR: AP4019238

(Physicotechnical Institute, AN SSSR)

SUBMITTED: 15Jul63   DATE ACQ: 27Mar64   ENCL: 00

SUB CODE: PH   NO REF SOV: 005   OTHER: 001

Card   3/3

L 58532-65   EWT(m)/T/EWA(m)-2
UR/0181/65/007/005/1331/1334

ACCESSION NR: AP5012537

AUTHOR: Shklyarevskiy, G. M.

TITLE: Dynamic polarization of protons in hydrated paramagnetic salts by the meth-od of multiple fast adiabatic passage through the forbidden line

SOURCE: Fizika tverdogo tela, v. 7, no. 5, 1965, 1331-1334

TOPIC TAGS: electron paramagnetic resonance, proton polarization, dynamic polariza-tion, paramagnetic salt, adiabatic fast passage

ABSTRACT: It is proposed to effect the dynamic polarization of photons in para-magnetic salts by multiple fast adiabatic passage through the forbidden electron paramagnetic resonance line. This causes inversion of the populations of the cor-responding levels of the energy spectrum of the electron system. The conditions which the fast adiabatic passage of the forbidden epr line must satisfy are deter-mined and it is shown that under such conditions the method makes it possible to obtain practically 100% polarization, in contrast with the method of saturation of the forbidden line, proposed by T. J. Schmugge and C. D. Jeffries (Phys. Rev. Lett. v. 9, 268, 1962). It is shown by means of a numerical example that in the case of

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L 58532-65

3

ACCESSION NR: AP5012537

the lanthanum double nitrate in which $\sim 1\%$ of the La atoms is replaced by the Nd, the number of cycles necessary to obtain full polarization is $s_0 \geqslant 10^3$, corresponding to ~ 50 seconds. "I thank B. S. Neganov and V. I. Lushchikov for a discussion of the work." Orig. art. has: 11 formulas.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute, AN SSSR)

SUBMITTED: 06Oct64   ENCL: 00   SUB CODE: SS, NP

NR REF SOV: 000   OTHER: 002

Card 2/2

SHKLYAREVSKIY, G.M.

Dynamic polarization of protons in hydrated paramagnetic salts by the method of multiple rapid adiabatic crossing of the forbidden line. Fiz. tver. tela 7 no.5:1331-1334 My '65.   (MIRA 18:5)

1. Fiziko-tekhnicheskiy institut imeni Ioffe AN SSSR, Leningrad.

SHKLYAREVSKIY, I.I.

*[Optical] Phase Relations at a Dielectric/Metal Interface. I. I. Shklyarevsky (Zhur. Tekhn. Fiziki, 1955, 25, (2), 333–342).—[In Russian]. (1) The magnitude and sign of the phase discontinuity which takes place when light is reflected from a dielectric/metal interface are obtained by several independent methods. Most of the values of these quantities given in the literature are shown to be wrong. (2) Measurements are given of the dispersion of phase discontinuity obtained when light is reflected from an air/Ag interface. (3) An instructive formula is derived for determining the thickness of thin films by an interference method. (4) A new interference method is given for determining the opt. const. of a metal. 18 ref.—A. E. B.

L 15986-66   EWT(1)/EWT(m)/T/EWP(e)   IJP(c)   WH

ACC NR: AP6005475   SOURCE CODE: UR/0368/66/004/001/0065/0067

AUTHOR: Shklyarevskiy, I. N.; Korneyeva, T. I.; Ryazanov, A. N.

ORG: none

TITLE: An interferometer method for determining the refractive indices of mica

SOURCE: Zhurnal prikladnoy spektroskopii, v. 4, no. 1, 1966, 65-67

TOPIC TAGS: refractive index, mica, interferometer, spectrum

ABSTRACT: A method is proposed for determining the dispersion of birefringence in silvered mica from a single interference pattern by measuring the wavelengths of the interference lines. The procedure is a modification of a previously proposed method (I. N. Shklyarevskiy, Opt. i spektr., 6, 780, 1959), and may be used for measuring the dispersion of refractive indices μ_γ and μ_β of mica in the visible region of the spectrum. Equations are derived for determining these indices and dispersion curves for the indices of refraction are given. The results agree satisfactorily with the tabulated values for the indices of refraction of Ural muscovite. Orig. art. has: 4 figures, 5 formulas.

SUB CODE: 20/ SUBM DATE: 19Apr65/ ORIG REF: 004/ OTH REF: 002
Card 1/1   UDC: 535.417

L 31535-66   EWT(1)/FCC   GW
ACC NR: AT6005154

SOURCE CODE: UR/2789/65/000/066/0073/0080

AUTHOR: Korobov, M.G.; Shklyarevskiy, V.G.

ORG: Central Aerological Observatory (Tsentral'naya aerologicheskaya observatoriya)

TITLE: A study of the topography of the upper boundary of cloudiness by the stereophotogram-metric method

SOURCE: Tsentral'naya aerologicheskaya observatoriya. Trudy, no. 66, 1965. Aerosinopti-cheskiye i aerologicheskiye issledovaniya (Aerosynoptic and aerological research), 73-80

TOPIC TAGS: stereophotography, aerial photography, atmospheric cloud

ABSTRACT: The stereophotogrammetric method applied in geodesy is employed for the topographic study of the upper surface of clouds, using aerial photography. Disregarding the physical factors in the origin of the nonuniformities on the cloud surfaces, the method makes it possible to determine the altitude of the clouds with sufficient accuracy. It is feasible to measure the height of cloud elements over other cloud elements by means of aerial photography. Knowledge of the scale of the photographs makes it possible to determine the length of the cloud waves as well. The calculations performed in the article show that the correction device of the stereometer may satisfactorily serve only small-scale aerial photographs. In conclusion, an evaluation is made of the accuracy of the determination of the excesses of the cloud elements obtained by the stereophotogrammetric method. Orig. art. has: 4 figures and 14 formulas.

SUB CODE: 04, 14 /SUBM DATE: none / ORIG REG: 004 / OTH REF: 001
Card 1/1

PYLI. YYIII, M. I.   Cand. Tech. Sci.

Dissertation: "Investigation of the Causes for Fractures in the Spring Luts of Two-
axle Freight Cars." Moscow Order of the Labor Red Banner Electromechanical Inst of Rail-
road Engineers named F. E. Dzerzhinskiy, 19 Nov 47.

So: Vechernyaya Moskva, Nov, 1947 (Project #17836)

SOV/137-58-12-24910

Translation from. Referativnyy zhurnal Metallurgiya, 1958, Nr 12, p 128 (USSR)

AUTHORS   Vintsel , G . Shklyarinskis, D.

TITLE   On the Preparation of High-grade Manganese Plating by Electrolysis
(K voprosu polucheniya kachestvenrykh pokrytiy pri elektroosazhdenii
margantsa)

PERIODICAL. Uch zap Vilnyussk un-t. Ser. matem., fiz. i khim n., 1957,
Vol 7, pp 133-137

ABSTRACT   The electrolytic deposition of Mn from a sulfate electrolyte (E) was
investigated   A study was made of the effect of the cathode cd, the
temperature. pH of the solution. concentration of Mn^{2+} and additives
on the current efficiency expressed in terms of the yield of metal
and the quality of the coating (C)   A glass membrane was used in
the electrolysis; Cu was used for the anode and graphite for the
cathode. The optimum composition of the E and the parameters of
the electrolysis were established   The catholyte was (in g/liter):
$MnSO_4$ $4H_2O$ 250, $(NH_4)_2SO_4$ 100; the anolyte was $(NH_4)_2SO_4$
100; pH 3 2 - 8 8; the E was stirred. High-grade C are produced
within a narrow range of the cathode-cd/temperature curve (within

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SOV/137-58-12-24910

On the Preparation of High-grade Manganese Plating by Electrolysis

the range of cathode cd = 8 - 23 amp/dm^2 and 0.5 - 20°C); at any given temperature the corresponding cathode cd should be selected. A deviation in either sense results in a sharp deterioration of the quality of C. The current efficiency increases with the increase in the cathode cd. The pH of the solution rises with the progress of electrolysis; at pH > 8.8 the quality of the deposits deteriorates and E should be acidulated with H_2SO_4. A decrease in the concentration of Mn^{2+} ions and Mn ions of a different valence exercises a negative effect on the quality of C and current efficiency. At 18° and cathode cd = 20 amp/dm^2 the current efficiency is 21% when the concentration of $MnSO_4 \cdot 4H_2O$ is 83 g/liter and 33.3% when it is 250 g/liter. Dendrites form on the edges and corners of the cathode as the growth in thickness of the deposit progresses. Addition of glycerol (40-50 g/liter) improves the quality of C, whereas addition of joiner's glue lowers it.

A. L.

Card 2/2

SHKLYARNIK, V.,mladshiy serzhant
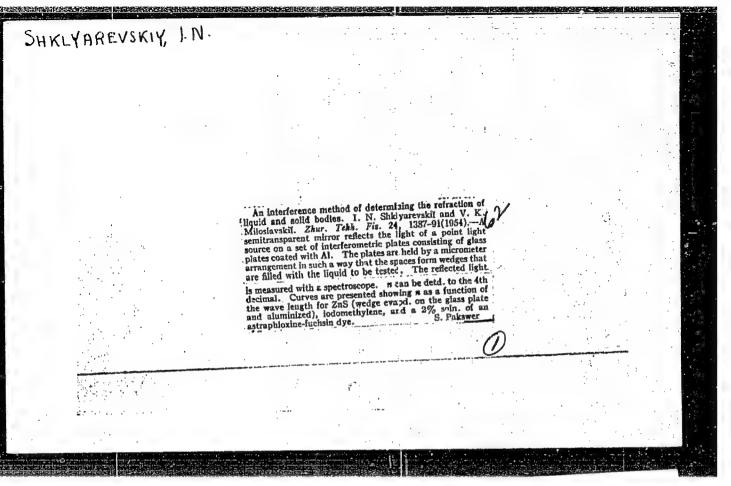
Training device for shooting from a tank. Voen.vest. 38 no.11:
80-82 N '58.   (MIRA 11:12)
(Tank warfare)

GALKIN, O.; SHKLYAREVS'KIY, I.N.

Change in the optical constants of tin during transition into a state of superconductivity. Dop.AN URSR no.6:445-447 '54.   (MIRA 9:9)

1.Fiziko-tekhnichniy institut AN URSR i Kharkivs'kiy derzhavniy universitet. Predstaviv diysniy chlen AN URSR K.D.Sinel'nikov.
        (Tin--Optical properties)

SHKLYAREVSKIY, I.N.

An interference method of determining the refraction of liquid and solid bodies. I. N. Shklyarevskiĭ and V. K. Miloslavskiĭ. *Zhur. Tekh. Fis.* 24, 1387–91(1954).—A semitransparent mirror reflects the light of a point light source on a set of interferometric plates consisting of glass plates coated with Al. The plates are held by a micrometer arrangement in such a way that the spaces form wedges that are filled with the liquid to be tested. The reflected light is measured with a spectroscope. n can be detd. to the 4th decimal. Curves are presented showing n as a function of the wave length for ZnS (wedge evapd. on the glass plate and aluminized), iodomethylene, and a 2% soln. of an astraphloxine-fuchsin dye.   S. Pakswer

K

USSR / Optics

Abs Jour: Referat Zhur-Fizika, 1957, No 4, 10340

Author : Sinel'nikov, K.D., Shklyarevskiy, I.N., Skorobogatov, B.S.
Inst : Not Given
Title : Determination of the Optical Constants of Germanium.

Orig Pub: Uch. zap. Kharkovsk. un-ta, 1955, 6, 135-140

Abstract: The index of refraction μ of thin germanium films was measured by the germanium-wedge method, coated in vacuum on glass or on silver. The average value $\bar{\mu}$ in the given region of the wedge thickness was obtained from the equation $\bar{\mu} = \lambda /\mu (t_{k\ min} - t_{k\ max})$ where $t_{k\ min}$ and t_{kmax} are the thicknesses of the germanium wedge in the locations of the k'th interference minimum and maximum for a given wavelength. For $\lambda = 590$ mμ the value of μ is independent of t all the way up to t on the order of 4×10^{-6} cm and equals 3.6 This shows that the structure of the films does not change with thickness. For $\lambda = 690$ and 550 mμ, the value of μ is 4.1 and 3.4μ

Card : 1/2

SHKLYAREVSKIY IN

K-5

Category : USSR/Optics - Physical Optics

Abs Jour : Ref Zhur - Fizika, No 2, 1957, No 4938

Author   : Shklyarevskiy, I.N., Miloslavskiy, V.K., Pakhomova, O.S., Ryazanov, A.N.
Title   : Interferometric Method for Determining the Dispersion of Liquids in the
           Ultraviolet Region

Orig Pub : Uch. zap. Khar'kovsk. un-ta, 1955, 6, 147-150

Abstract : The previously described (Referat Zh. Fizika, 1955, 23123) interfero-
           metric method for determining the dispersion of liquids and solids, based
           on the application of the lines of equal chromatic order, has been
           expanded to determine the dispersion of liquids in the ultraviolet region.
           The investigated liquid is introduced into a gap between aluminized quartz
           plates, which are attached to the slit of an ISP-22 quartz spectrograph.
           The thickness of the gap is regulated by means of screws. The resultant
           spectrogram is used to determine the wavelengths of many interference
           lines, to determine their interference order, and knowing the thickness
           of the gap, to calculate the index of refraction for many wavelengths.
           The order of the interference is determined by filling the gap half with

Card   : 1/2

VERKIN, B.I.;MIL'NER, A.S.; ROZENTSVEYG, L.N.; FAYNBERG, Ya.B.; KHOTKEVICH, V.I.; SHKLYAREVSKIY, I.N.

Sections of Experimental, Theoretical, and General Physics at the Department of Physics and Mathematics, 1930-1955. Uch.zap.KHGU 60:63-79 '55.   (MIRA 10:1)
                    (Kharkov University--History)
                               (Physics)

SHKLYAREVSKIY, I.N.

SINEL'NIKOV, K.D.; SHKLYAREVSKIY, I.N.; KENR, E.A.

Interference of light in thin silver foils.   Uch.zap. KHGU.
                                                           (NLRA 10:7)
64   no.6:127-134   '55.
            (Interference (Light)) (Metallic films--Optical properties)

SINEL'NIKOV, K.D.; SHKLYAREVSKIY, I.N.; SKOROBOGATOV, B.S.

Determination of the optical constants of germanium.   Uch.zap.
KHGU   64   no.6:135-140   '55.   (MIRA 10:7)
                   (Germanium--Optical properties)

SHKLYAREVSKIY, I. N.

K-5

USSR/Optics - Physical Optics.

Abs Jour   : Referat Zhur - Fizika, No 3, 1957, 7698

Author   : Sinel'nikov, K.D., Shklyarewskiy, I.N., Lupashko, Ye.A.
Title   : Optical Properties of Intermetallic Compounds. Zinc-
              Antimony Compound.

Orig Pub   : Uch. zap. Khar'kovsk. un-ta, 1955, 64, 141-144

Abstract   : The antimonoid of zinc (I) was obtained with S.A.
              Vekshinskiy's method by simultaneous sublimation of zinc
              and antimony on glass in vacuum. A portion of the com-
              plex film corresponding to I was obtained by measuring
              the specific conductivity, which for I is 2.5 x 10^{-3}
              ohm^{-1} cm^{-1}. Such portions have an increased transparen-
              cy T and at thicknesses t $>$ 1,000 A they have a brown
              hue in transmitted light. The dependence of T on λ
              was measured with the SF-4 spectrophotometer in the 350
              -- 1100 mμ region in a large number of films of diffe-
              rent t, and the absorption coefficient $\mu \chi$ was calcula-
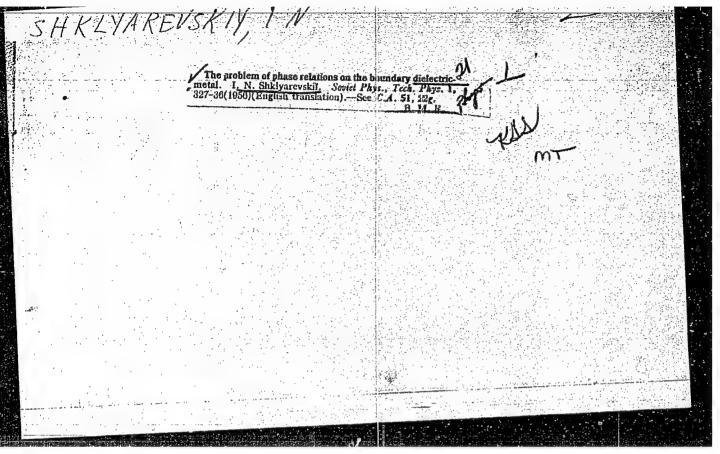   ted

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from the equation, $\chi = \lambda$ ln $(T_1/T_2)/ 4 \pi (t_2 - t_1)$.
Films were selected with such value of t as to make the
light interference negligible and to make it possible
to assume the coefficient of reflection of the various
films to be the same. The curve $\chi = f(\lambda)$ decrea-
ses rapidly towards the shorter waves, indicating the
presence of an absorption band in the ultraviolet region
of the spectrum. The optical density in the region of
400 -- 1,000 mμ is independent of the temperature in
the range from 20 -- 105°.

Card 2/2   - 29 -

SHKLYAREVSKIY, I N

The problem of phase relations on the boundary dielectric-metal. I. N. Shklyarevskii. *Soviet Phys., Tech. Phys.* 1, 327–36(1956)(English translation).—See *C.A.* 51, 12g.
B. H. B.

USSR/Optics - Physical Optics, K-5

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 35731

Author: Sinel'nikov, K. D., Shklyarevskiy, I. N. Vlasenk, N. A.

Institution: None

Title: Optical Characteristics of Complex Interference Light-Filters

Original
Periodical: Zh. tekhn. fiziki, 1956, 26, No 1, 96-101

Abstract: For the green region of the spectrum, complex interference light filters were prepared, consisting of 3 reflecting layers and 2 dielectric layers between them. The dielectric used was barium fluoride, and the reflecting layers were silver. In some cases the third reflecting layer was a multilayer dielectric coating. The optical characteristics of such light filters were investigated using a matching method previously proposed (Uch. zap. Khar'kovsk. gos. un-ta., Tr. fiz. otd., 1955, 6, 147). The transmission band was recorded with a DFS-4 spectrometer with a diffraction grating, having 600 lines/mm. It was shown that the transmission band of

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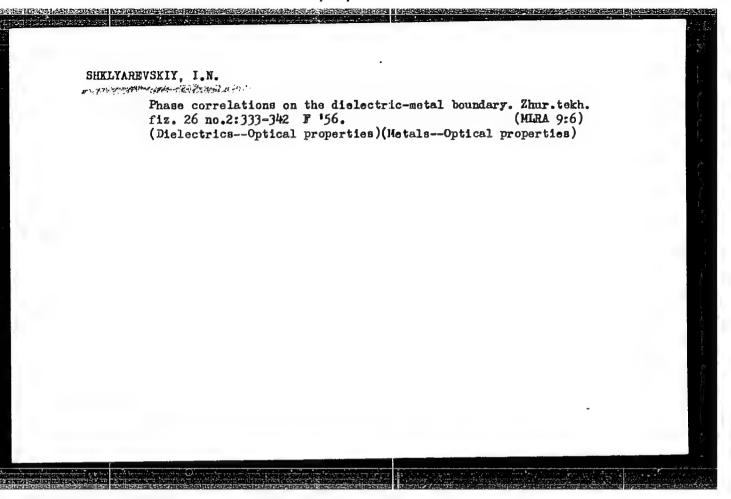USSR/Optics - Physical Optics, K-5

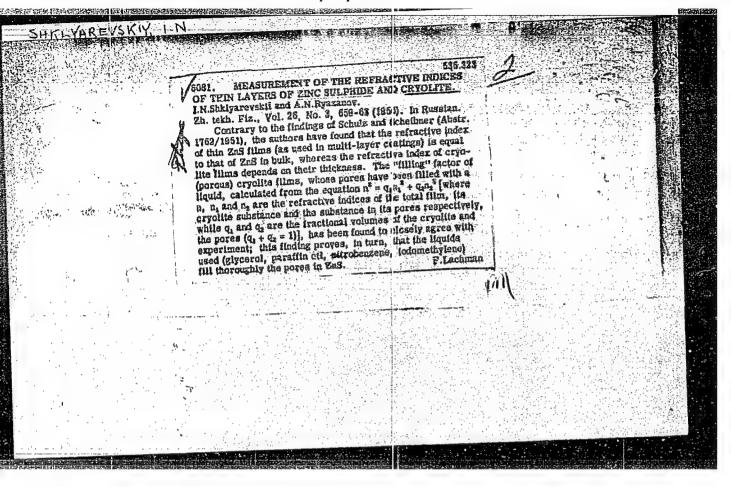Abst Journal: Referat Zhur - Fizika, No 12, 1956, 35731

Abstract: complex light filters is 5-10 times narrower than in simple inter-
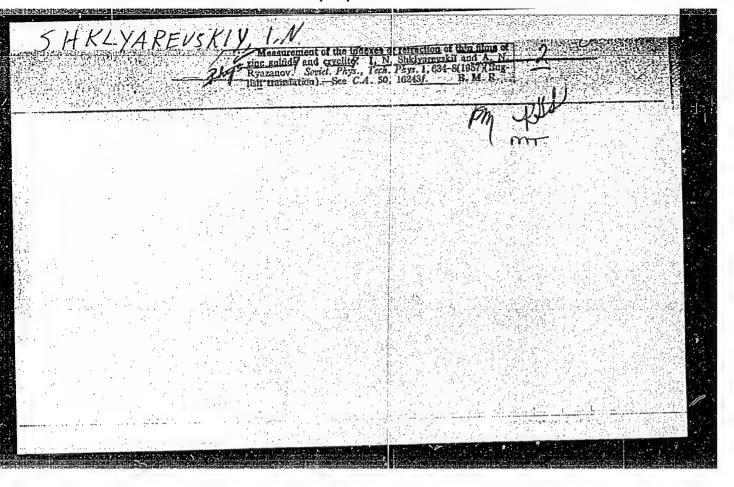ference filters (30-100 A instead of 200-400 A), and the trans-
parency is 1.5-2 times better (30-60% instead of 20-30%). The use
of a multilayer dielectric coating instead of a silver reflecting
layer improves the quality of the filters. Further improvement in
the optical characteristics lies along the path of replacing of all
the silver layers with multiple-layer dielectric coatings.

Card 2/2

SHKLYAREVSKIY, I.N.

Phase correlations on the dielectric-metal boundary. Zhur.tekh.
fiz. 26 no.2:333-342 F '56. (MLRA 9:6)
(Dielectrics--Optical properties)(Metals--Optical properties)

SHKLYAREVSKIY I.N

536.323

6081.   MEASUREMENT OF THE REFRACTIVE INDICES
OF THIN LAYERS OF ZINC SULPHIDE AND CRYOLITE.
I.N.Shklyarevskii and A.N.Ryazanov.
Zh. tekh. Fiz., Vol. 26, No. 3, 658-63 (1956). In Russian.

Contrary to the findings of Schulz and Scheibner (Abstr. 1762/1951), the authors have found that the refractive index of thin ZnS films (as used in multi-layer coatings) is equal to that of ZnS in bulk, whereas the refractive index of cryolite films depends on their thickness. The "filling" factor of (porous) cryolite films, whose pores have been filled with a liquid, calculated from the equation $n^2 = q_1 n_1^2 + q_2 n_2^2$ (where n, n_1 and n_2 are the refractive indices of the total film, its cryolite substance and the substance in its pores respectively, while q_1 and q_2 are the fractional volumes of the cryolite and the pores ($q_1 + q_2 = 1$)], has been found to closely agree with experiment; this finding proves, in turn, that the liquids used (glycerol, paraffin oil, nitrobenzene, iodomethylene) fill thoroughly the pores in ZnS.   F.Lachman

SHKLYAREVSKIY, I.N.

Measurement of the indexes of refraction of thin films of zinc sulfide and cryolite. I. N. Shklyarevskii and A. N. Ryazanov. Soviet. Phys., Tech. Phys. 1, 634-8(1957)(English translation). See C.A. 50, 16243f. B. M. R.

SHKLYAREVSKIY, I.N.

AUTHORS: Sinel'nikov, K.D., Shklyarevskiy, I.N. and Vlasenko, N.A.

TITLE: Complex interference optical filters with improved characteristics. (Slozhnyye interferentsionnyye svetofil'try s uluchshennymi kharakteristikami).

ABSTRACT: This note describes construction of several types of optical filters and is the continuation of earlier work by Sinel'nikov et al. (Uchenye zapiski Kharkovskogo gosudarstvennogo Universiteta, Trudy fizicheskogo otdeleniya, Vol.6, 147, 1955; Zh. tekh. Fiz., Vol.26, 96, 1956). $M_1D_1M_2D_2M_3$ filters (M's are reflecting layers and D's dielectric layers) were prepared as follows: to an $M_1D_1M_2$ filter (D_1 of barium fluoride) an M_3 layer in the form of a glass plate was attached and D_2 was a wedge-shaped layer of air between M_2 and M_3. The filter was made "consistent" by illumination with white light, observation of the resulting interference pattern via a spectroscope and appropriate adjustment of D_2. No numerical values of the characteristics are given. $M_1D_1M_2D_2M_2D_1M_1$ filters, with D_1 of barium fluoride and D_2 a layer of air, similar to those of A.Hermansen (Nature, 174, 218, 1954) were prepared. With reflection coefficients $R_1 = 83\%$ and

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Complex interference optical filters with improved characteristics. (Cont.)

$R_2 = 93\%$ for M_1 and M_2 respectively, an overall transmission of 30% was obtained with a pass band (centred on 5000 Å) of only 45 Å and "contrast" of about 10^5. A method of preparation of filters, similar to that for Fabry-Perot etalons, is also described. Two high-quality glass flats were covered with the usual layers (silver and barium fluoride) by vacuum evaporation; they were the $M_1D_1M_2$ systems. A wedge-shaped layer of air D_2 was left between the two plates. Light from a monochromator (of wavelength of the maximum of the filter pass-band) was made parallel by means of a lens focussed on the exit slit of the monochromator. This light was directed on to the filter. When D_2 was wedge-shaped hundreds of interference lines were visible. When the two surfaces M_2 became parallel the lines disappeared and the illumination became uniform. Then, keeping the plates parallel, they were adjusted by screws to give maximum uniform illumination ("consistent" state). There are 1 table and 6 references (4 of which are Slavic.)

ASSOCIATION: Kharkov State University.(Khar'kovskiy Gosudarstvennyy Universitet.

SUBMITTED: September 15,1956.

ard 2/2 AVAILABLE: Library of Congress

Dispersion of the Phase Change of Thin Aluminium Layers.   51-5-15/26

ively, and were obtained for a sample shown in Fig.1a. The
upper diffuse lines are due to Al-ZnS-air; the lower lines
are due to Al-ZnS-Al, with iron lines (for calibration)
superimposed on them. These lines are displaced towards
short wavelengths by a value which represents a negative
phase change at the boundary ZnS-Al. The phase change,
denoted by ψ(ZnS-Al), is plotted against wavelength, λ , in
Fig.4 (the continuous curve represents the present authors'
results, the broken curve- the results calculated from
optical constants of Al measured by O'Bryan, Ref.5). III and
IV in Fig.3 were obtained for a sample shown in Fig.1b.
The upper lines are due to Al-ZnS-Al (thin layer:-195 Å).
They are displaced towards longer wavelength which indicates
that the phase change on reflection at a thin Al layer is
less than at a thick layer. Fig.3, V was obtained for an
even thinner Al layer (50 Å) and the phase change was found
to be still less than in III and IV. On decrease of layer
thickness to 50-80 Å the displacement of the equal-
chromatic-order lines was greater than in the absence of
such layers. Presence of such layers on ZnS deterioriates
the sharpness of these lines. With decrease of the layer

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Dispersion of the Phase Change of Thin Aluminium Layers. 51-5-15/26

thickness the phase change becomes negative (Fig.5, where numbers at each curve denote layer thickness in angstroms). Fig.6, I, shows dependence of the phase change ψ on thickness t (in Å) for λ = 5500 Å. Curve II in Fig.6 is calculated from the optical constants for bulk Al given by O'Bryan (5). At the top right-hand corner of Fig.6 two parallel dashes denote the value of ψ for bulk Al. The results in Fig.6 are taken by the authors as an indication that the optical constants of thin Al films vary with thickness. This conclusion forms the basis of the authors' explanation of the observed behaviour of Al films. The authors thank Prof. K.D. Sinel'nikov for advice. There are 7 figures, 13 references, 8 of which are Slavic.

ASSOCIATION: Kharkov State University. (Khar'kovskiy Gosudarstvennyy Universitet)

SUBMITTED: October 15, 1956.

AVAILABLE: Library of Congress.

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51-5-16/26

Double refraction of fluoride films.

The absolute size of the particles, so long as it is smaller than light wavelength, is not important. For many substances the dimensions of microcrystallites and the distances between them are considerably smaller than visible light wavelength, and therefore in that region one would expect anisotropy of the film. Double refraction was, in fact, found by the authors in films of CaF_2, BaF_2, LiF, PbS, V_2O_5 and other substances obtained by deposition on a glass base in vacuum. On introducing such a film between two crossed nicols one can observe fairly strong transmission in the field of vision. This transmission is at maximum when the glass with film on it is so oriented that the direction given by the cross section of the plane of the base with the plane of incidence of the evaporated molecular beam is at an angle of 45° to the direction of polarisation of the nicols. Wetting of the film by liquids of various refractive indices decreases the intensity of the transmitted light. The transmission becomes zero on wetting with a liquid whose refractive index is equal to the refractive index μ_1 of the bulk substance. Double refraction of the fluoride films may be also studied by an interferometric method. On a glass plate a semi-transparent silver layer is deposited. On silver a calcium fluoride layer in a form of a

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Double refraction of fluoride films.   51-5-16/26

     symmetrical hill is deposited which is then covered by
another semitransparent silver layer. In monochromatic
light a system of double rings is observed (Fig.2). The
equal chromatic order lines are split in a similar way.
(Fig.3). The results show that the fluoride layers possess
biaxial double refraction and that the plane of the optical
axes coincides with the plane of incidence of the molecular
beam. The orientation of the refractive index ellipsoid
relative to the layer of the film depends on the angle of
incidence of the molecular beams on to the base in the pro-
cess of the deposition of the film. The magnitude of the
double refraction also depends on this angle of incidence.
The results are shown in Figs.6 - 10. There are 10 figures,
and 11 references, of which 8 are Slavic.

ASSOCIATION: Kharkov State University (Khar'kovskiy Gosudarstvennyy
     Universitet)

SUBMITTED: October 15, 1956.

AVAILABLE: Library of Congress
Card 3/3

Measurement of the Optical Constants of Tin by an Interferometric Method.

and mica were used. ZnS was deposited in vacuum at 5×10^{-5} mm Hg. Thin leaves of mica were all obtained from the same sample. The sample was fixed in front of a Tolansky (Ref.4) spectrograph. The interference fringes were photographed in reflected light. As a result of the phase-change differences at the boundaries dielectric-silver and dielectric-studied metal, the interference bands due to the system Ag-D-M are displaced with respect to the bands due to the system Ag-D-Ag. The interferometric method described here is applicable only to those metals for which the refractive index μ and the absorption co-efficients $\mu\chi$ are of the same order when the reflection coefficient of the metal is not less than 50 to 60%. At small coefficients of reflection the interference lines were recorded immediately after the preparation of samples. Figs.2, 3 show interference for one of the samples. Fig.2 corresponds to wavelengths 6500-4800 Å and Fig.3 to 5000 to 4100 Å. The upper lines correspond to the Ag-ZnS-Ag part of the sample and the lower lines to the Ag-ZnS-Sn system. For

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51-5-17/26

Measurement of the Optical Constants of Tin by an Interferometric
Method.

where λ = wavelength in μ. The results are given in the
adjoining table and they yield a value of 2.5 conduction
electrons per atom. Students L.Sukhacheva and E.Pavlova
carried out the experimental work. The authors thank
Prof. K.D. Sinelnikov for valuable advice and interest.
There are 5 figures and 7 references, 4 of which are Slavic.

ASSOCIATION: Kharkov State University (Khar'kovskiy Gosudarstvennyy
        Universitet)

SUBMITTED: October 15, 1956.

AVAILABLE: Library of Congress.

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51-4-11/26

A New Modification of the Polarization Method of Measurement of the
Optical Constants of Metals.

for the refractive index μ and the absorption
coefficient $\mu\chi$ in terms of measurable quantities:
angle of incidence φ , azimuth of reduced (relative)
polarization ψ , and phase difference between the
p and s components after one reflection Δ . The
apparatus used is shown in Fig.1. A monochromatic,
parallel, linearly polarized (by polarizer P, at an
angle of 45° to the plane of incidence) beam falls on
plates (1) and (2) with mirrors of the studied metal
deposited on them. The two plates are attached to a
goniometer table; one of them is fixed and the other
can be moved parallel to it. The light, reflected
three times by the metallic surfaces, falls on an
analyser, A, whose angle of rotation can be read down
to 2 minutes of arc. r is a receiver of radiation.
First the second plate is in the position 2'. Its
displacement to position 2 makes it possible to obtain
quintuplet reflection if necessary. In the visible
region the source of light is the exit slit (5) of a
monochromator YM-2. Glan prisms serve as the

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51-4-11/26

A New Modification of the Polarization Method of Measurement of the Optical Constants of Metals.

the receiver.   This angle of incidence was measured several times, and a mean value was taken.   Mean values of ψ were also obtained.   Knowing φ , ψ and Δ = - 60°, the optical constants of the metal could be calculated from Eqs. 6 and 7.   Measurements of the optical constants of metals for light falling from the glass side (Fig.2) did not differ in principle from measurements using light falling from the air side.   The authors applied the method to measurement of the optical constants of aluminium in the visible region.   These constants were measured earlier by O'Bryan (Ref.1), in vacuo because a layer of oxide is always present on aluminium in air.   To exclude the effect of oxide the present authors used the apparatus of Fig.2.   Aluminium layers were deposited on the surfaces AA' and CC' at 5 x 10⁻⁵ mm Hg.   To avoid any contamination, for the first few moments aluminium was evaporated on a special screen and only then on the surface of the prism of Fig.2.   Table 1 gives the results of measurements thus obtained (triple reflection with Δ = - 60°).   This table gives (in

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51-4-11/26

A New Modification of the Polarization Method of Measurement of the Optical Constants of Metals.

This shows the great influence of the oxide layers in measurement of the optical constants from the air side. The highest values of the optical constants were obtained from the glass side. O'Bryan's results are lower; results for samples measured on the air side after 6 hours are still lower, and the results for samples measured 50 days after deposition are the lowest of all. The authors concluded that aluminium surfaces used by O'Bryan, although prepared and measured in vacuo, were covered by an oxide layer about 25 Å thick. Samples measured in air after 6 hours and those measured after 50 days are estimated to have had oxide layers 74 and 97 Å thick respectively. The oxide thicknesses estimated by the present authors for freshly prepared samples (6 hours after deposition) were several times higher than those calculated by Hass (Ref.10). This is because Hass did not take into account the oxide layer formed in vacuo. The authors thank Professor K.D. Sinel'nikov for valuable discussions and his interest. There are 2 figures, 2 tables and 10 references, 4 of which are Slavic.

Card 6/7

Shklyarevskiy, I. N.

51-6-13/25

AUTHOR: Shklyarevskiy, I. N.

TITLE: A New Interferometric Method for Determination of
            the Optical Constants of Metals. (Novyy inter-
            ferometricheskiy metod opredeleniya opticheskikh
            postoyannykh metallov.)

PERIODICAL: Optika i Spektroskopiya, 1957, Vol. III, Nr. 6,
            pp. 638-640.   (USSR)

ABSTRACT: This paper describes a new interferometric method
            for determination of the optical constants of metals,
            based on the measurement of the difference of phase-
            shifts of the p- and s-components of polarized light
            at two angles of incidence onto a surface of the
            metal studied (deposited on interferometer plates).
            On oblique incidence of light on the interferometer
            plates a splitting of the equal-chromatic-order lines
            is observed (Refs.3,4).   The magnitude of this
            splitting depends on the angle of incidence φ,
            increasing with increase of that angle.   The long-
            wavelength components obtained on splitting are found
Card 1/3   to be polarized in the plane of incidence, and the

51-6-13/25

A New Interferometric Method for Determination of the Optical
Constants of Metals.

short-wavelength ones – perpendicularly to the plane
of incidence.   Splitting of the interference lines
is due to the difference of the phase-shifts of the
p- and s-components, which are produced on reflection
from the metal.   Splitting of the equal-chromatic-
order lines can be used to find Δ , the difference
between the phase-shifts of the p- and s-components,
for any angle of incidence φ.   From two pairs of
values of Δ and φ the refractive index μ and
the absorption coefficient μx may be found at any
given wavelength using the well-known equation relating
Δ , φ, μ and μx (Eq.6 on p.639).   This equation
is valid for bulk metal, while the layers on the
interferometer plates are thin and semitransparent.
To avoid errors due to the thinness of the inter-
ferometer layers the following method was adopted.
Measurements were made on two identical semitrans-

.Card 2/3   parent silver films at two angles of incidence.

SOV/51-4-6-13/24

AUTHORS: Shklyarevskiy, I.N., Starunov, N.G. and Padalka, V.G.

TITLE: Measurement of Optical Constants of Silver in the Infrared Spectral Region (Izmereniye opticheskikh postoyannykh serebra v infrakrasnoy oblasti spektra)

PERIODICAL: Optika i Spektroskopiya, 1958, Vol IV, Nr 6, pp 792-795 (USSR)

ABSTRACT: Optical constants of metals are of great interest in the electron theory of metals if they are measured in the frequency region which satisfies the inequality given by Eq. 1 on p. 792: $\nu_0^2 \ll \nu^2 \ll \omega_0^2$, where ν_0 is the frequency of electron collisions with the crystal lattice and ω_0 is the frequency corresponding to the upper limit of the internal photoeffect. This frequency region lies usually in the infrared part of the spectrum. The present paper reports measurements of optical constants of silver in the 1-12 μ region using the methods described earlier (Refs 1, 2). In the first of these methods (Ref 1) the phase difference $\Delta = \delta_p - \delta_s$ between the p- and s- components is made equal to -180° by multiple reflection of light by two identical samples. The apparatus used is shown in Fig 1. Here S is the exit slit of a monochromator SMR-2; Z_1, Z_2, Z_3 and Z_4 are aluminized

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SOV/51-4-6-13/24

Measurement of Optical Constants of Silver in the Infrared Spectral Region

mirrors; P and A are a polarizer and an analyser, respectively, made of piles of six selenium plates which are placed at an angle of the order of 70° to the light-beam; M_1 and M_2 are the samples of the studied metal; B is a receiver. A parallel beam of monochromatic light passes through a polarizer, which is positioned at an angle of 45° to the plane of incidence, and falls at an angle φ on to samples M_1 and M_2. The angle of incidence is chosen to make $m\Delta = -180°$, where m is the number of reflections from metal samples. Under these conditions the light reflected from metal samples may be extinguished by the analyser. Position of the analyser gives the value ψ', which is related to the azimuth of restored polarization ψ by the relationship $\tan \psi = \sqrt[n]{\tan \psi'}$. Knowing the angle of incidence φ, the phase difference Δ and the azimuth ψ the optical constants can be easily calculated. The second method of "rotating analyser" (Ref 2) is based on a conversion of elliptically polarized into circularly polarized light. The apparatus is the same as in Fig 1. By a suitable choice of the angle of incidence φ, for a given wavelength, the condition $m\Delta = -90°$ is satisfied and the amplitudes of the p- and s-components are made equal by a suitable rotation of the polarizer. Then the light reflected from metal surfaces

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Measurement of Optical Constants of Silver in the Infrared Spectral Region

is circularly polarized. The modulated component which has passed
through the rotating analyser disappears and the recording instrument
shows only a constant signal. The azimuth of the restored polarization
is obtained as in the first method, but ψ now represents the angle
between the chief direction of the polariser and the plane of incidence
of light. From measured values of ϕ, Δ and ψ the optical constants μ
(refractive index) and $\mu\chi$ (absorption coefficient) are obtained. The
optical constants of silver layers produced by evaporation in vacuum
were measured by both these methods. The results are shown in the
table on p. 795 whose columns give respectively the wavelength (in μ),
the angles of incidence ϕ, the number of reflection m, the phase
differences $-\Delta$, the azimuth ψ, the refractive indices μ and the
absorption coefficients $\mu\chi$. Fig 2 compares the values of the
refractive index and the absorption coefficient (curves 1 and 2
respectively) obtained by the present authors (shown by open circles)
with those of Forsterling and Freedericksz (Ref 7, shown by black dots)
and those of Motulevich and Shubin (Ref 6 shown by half-black dots).
All these values are shown as a function of wavelength and they agree
well with each other, except for values of the refractive index in

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Measurement of Optical Constants of Silver in the Infrared Spectral Region

the 3.5-6 μ region reported in Ref 6. In the spectral region where the inequality given by Eq. 1 on p. 792 is satisfied the conduction electron density N is independent of the wavelength λ. If N is constant it follows that $(\mu n)^2 - \mu^2 + 1 = f(\lambda^2)$ which should be a straight line. Such a straight line is shown in Fig 3. In the region 5-12 μ the slope of this line gives the conduction electron density as $7.4 \times 10^{22} cm^{-3}$. The experimental points in Fig 3 in the region 1-6 μ also lie on a straight line whose slope gives the conduction electron density as $5.2 \times 10^{22} cm^{-3}$, which is the same as the number of atoms of silver in 1 cm^3. The authors thank K.D. Sinel'nikov for his interest and advice. There are 3 figures, 1 table and 8 references, 4 of which are Soviet, 2 English, 1 German and 1 American.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A.M. Gor'kogo
(Kharkov State University imeni A.M. Gor'kiy)

SUBMITTED: November 15, 1957

Card 4/4

SOV/51-5-5-19/23

AUTHOR: Shklyarevskiy, I.N.

TITLE: On the Problem of Measurement of Thickness of Thin Layers Using
            Equal Chromatic Order Lines (K voprosu ob izmerenii tolshchin
            tonkikh plenok s pomoshch'yu liniy ravnogo khromaticheskogo poryadka,

PERIODICAL: Optika i Spektroskopiya, 1958, Vol 5, Nr 5, pp 617-619 (USSR)

ABSTRACT: In 1945 Tolansky applied equal chromatic order lines to the study of
            topography of almost plane surfaces, using white light.   Later
            Sinel'nikov and Rapp (Ref 2) applied Tolansky's method to measurement
            of thin films deposited in vacuo on glass plates.   A scratch is made
            across such a film.   The film is then covered (by vacuum deposition)
            by an opaque layer of silver which repeats the scratch contours forming
            a small step.   The height of this step is equal to the original film
            thickness.   A second glass plate is covered by a semi-transparent
            layer of silver.   The two plates are pressed together and are placed
            in front of a spectrograph slit in such a way as to place the step,
            referred to above, at right angles to the slit.   These plates are
            illuminated with a parallel beam of white light;   details of the
            apparatus are given in Refs 3, 4.   An achromatic lens is used to focus

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On the Problem of Measurement of Thickness of Thin Layers Using Equal Chromatic
Order Lines

the air gap between the glass plates on to a spectrograph slit. In
the focal plane of the spectrograph camera objective two systems of
equal chromatic order lines are observed (Fig 1). The separation
between the two systems of lines is a function of the original film
thickness. Wavelengths of both systems of lines were measured in
the spectral region 5000-6500 Å. For each of the systems a graph of
the function $m\lambda/2 = f(\lambda)$ is constructed. Here $m = k - 1$, where k is
the interference order of a particular line. Fig 3 shows such functions
obtained from the interferogram of Fig 1. The difference between
ordinates of the two straight lines shown in Fig 3 is equal to the
original film thickness t (in the present case it was 260 Å). When
film thickness is of the order of several wavelengths the air gap between
the interference plates is chosen to make the m-th line of one system
to coincide with the n-th line of the other system, as shown in Fig 2.
Then $t = \lambda_1(m - n)/2$, where t is the original film thickness and λ_1 is
the wavelength at which the m-th and n-th lines of the two systems

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On the Problem of Measurement of Thickness of Thin Layers Using Equal Chromatic
Order Lines

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coincide. For the case given in Fig 2 λ_1 = 6176 $\overset{o}{A}$, m - n = 4 and
t = 1.225 μ. The author thanks K.D. Sinel'nikov for his advice.
There are 3 figures and 5 references, 4 of which are Soviet and
1 English.

SUBMITTED: April 29, 1958

Card 3/3   1. Thin films--Measurement   2. Thin films--Testing equipment
             3. Spectrophotometers--Performance   4. Mathematics   5. Silver
             --Applications

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Translation from: Referativnyy Zhurnal Fizika, 1959, Nr 7, p 259 (USSR)

SOV/58-59-7-16481

AUTHOR: Shklyarevskiy, I.N.

TITLE: Measuring the Optical Constants of Metals in the Infrared Region of the Spectrum Using the "Rotating Analyzer" Method

PERIODICAL: Uch. zap. Khar'kovsk. un-t, 1958, Vol 98, Tr. Fiz. otd. fiz.-matem. fak., Vol 7, pp 325 - 328

ABSTRACT: In order to determine the optical constants of metals in the infrared region, the author used the rotating polarizer method of Konn (Russ. spelling) and Eaton (RZhFiz, 1956, Nr 2, 14657) in conjunction with the repeated reflection of light from two identical surfaces of the metal to be investigated. Light from the monochromator passes through the polarizer (a selenium pile), is reflected from the two parallel samples, and passes through the slowly rotating analyzer and on to the radiation receiver. By gradually varying the angle of incidence of the light on the samples, an angle of incidence is found at which the reflected light is circularly polarized, i.e., the signal at the analyzer is constant. Then the optical constants are calculated from the known

Card 1/2

SHKLYAREVSKIY, I. N. Doc Phys-Math Sci -- (diss) "Certain problems of metallooptics."
Khar'kov, 1959. 22 pp (Min of Higher and Specialized Secondary Education UkSSR.
Khar'kov Order of Labor Red Banner State Univ im A. M. Gor'kiy), 150 copies. List
of author's works at end of text (26 titles) (KL, 44-59, 125)

-1-

51-6-1-13/30

AUTHORS: Shklyarevskiy, I.N. and Padalka, V.G.

TITLE: Measurement of the Optical Constants of Copper, Gold and Nickel in
             the Infrared Region of the Spectrum (Izmereniye opticheskikh
             postoyannykh medi, zolota i nikelya v infrakrasnoy oblasti spektra)

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 1, pp 78-84 (USSR)

ABSTRACT: The optical constants of copper, gold and nickel were measured in the
             region of 1-12 μ by means of the method described by Shklyarevskiy et al
             (Refs 4, 5).   Measurements were made on a number of pairs of samples
             and in each case reproducible values of the refractive index μ and the
             absorption index $\mu\chi$ were obtained.   The results of measurements are
             given in Tables 1-3.   The seven columns of each table give the
             wavelength λ, the angle of incidence of the light φ, the number of
             reflections n, the phase shift Δ, the azimuth ψ, the refractive index μ
             and the absorption index $\mu\chi$. The optical constants were calculated from
             the usual formulae (Eqs 5 and 6) which give μ and $\mu\chi$ in terms of φ, ψ
             and Δ. Thick layers of copper were prepared by vacuum deposition on
             glass plates. Measurements of the optical constants of copper were
             made within five days. Control measurements carried out on freshly
Card 1/3   prepared samples yielded the same optical constants as the measurements

SOV/51-6-1-13/30

Measurement of the Optical Constants of Copper, Gold and Nickel in the Infrared
Region of the Spectrum

carried out after five days. The effect of a layer of copper oxide
was neglected; according to Hodgson (Ref 6) such a layer should not
affect the optical constants by more than a few per cent. The results
obtained for copper are given in Table 1 and the derived optical constants
are shown in Fig 1, where the open circles represent the authors'
results and the black dots represent those of Försterling and
Freederichsz (Ref 7). Layers of gold 1.5-2 μ thick were deposited on
glass plates by vacuum deposition. No differences were found between
optical constants derived from measurements made seven days after
evaporation and optical constants derived from measurements carried out
one month after preparation of the samples. The results are given in
Table 2 and the derived optical constants are shown in Fig 2. Again
open circles denote the present authors' results and the black dots
those of Försterling and Freederichsz (Ref 7). Thin layers of nickel
were deposited by vacuum deposition on glass plates. The results obtained
are given in Table 3 and the derived optical constants in Fig 3,
where open circles denote the present authors' values, and triangles
show the optical constants obtained by Ingersoll (Ref 8) at $\lambda = 2$ μ.

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Measurement of the Optical Constants of Copper, Gold and Nickel in the Infrared
Region of the Spectrum

Using the classical Drude theory of free electrons in metals the
authors calculated densities of free electrons, relaxation times and
d.c. conductivities of copper, gold, nickel and silver. They are
given in Table 3, together with results taken from Hodgson's and
Beattie and Conn's work (Refs 8, 10). From the known values of μ
and χ it is possible to calculate the value of the absorption
coefficient A given by

$$ a = 1 - R = \cdots $$

where R is the reflection coefficient of the metal. Dependence of
the absorption coefficient A on wavelength is given for copper, silver,
gold and nickel in Fig 1. The ordinate axis I applies to copper, gold
and silver and the axis II applies to nickel. Acknowledgments are made
to Professor A.D. Smel'nikov for his advice. There are 7 figures, 4 tables
and 15 references, 6 of which are Soviet, 3 English 2 German 1 Dutch and
1 translation.

SUBMITTED: March 24, 1957

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24(4), 24(6)   SOV/51-6-4-19/29

AUTHORS: Shklyarevskiy, I.N., Avdeyenko, A.A. and Padalka, V.G.

TITLE: Measurement of the Optical Constants of Antimony in the Infrared Spectral
              Region at Temperatures of 290 and 110°K. (Izmereniye opticheskikh
              postoyannykh sur'my v infrakrasnoy oblasti spektra pri temperature
              290 i 110°K)

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 4, pp 528-532 (USSR)

ABSTRACT: The optical constants of antimony were measured at the wavelengths
              of 1-12 μ and at temperatures of 290 and 110°K, using the technique
              described by Avery (Ref 3) which is essentially a measurement of
              $$\rho^2 = R_p/R_s ,$$
              at two angles of incidence φ (R_p and R_s are the coefficients of
              reflection for light polarized in the plane of incidence and at
              rightangles to it). Avery obtained the refractive (μ) and
              absorption ($\mu\chi$) indices from a system of two equations
              $$\rho_1^2 = f_1 (\mu, \mu\chi, \varphi_1) \text{ and } \rho_1^2 = f_2 (\mu, \mu\chi, \varphi_2).$$
              This method of calculation is laborious and the authors used the
              method of intersecting circles (Ref 4). The procedure described here
Card 1/4   is applicable to the optical constants of metals for which $\mu \approx \mu\chi$;
              the optical constants of antimony satisfy this condition. The

Measurement of the Optical Constants of Antimony in the Infrared Spectral Region at Temperatures of 290 and $110^{\circ}K$

apparatus used for measurement of the optical constants of metals in the infrared region was described earlier (Ref 1). The apparatus used in studies of antimony differed from that described earlier (Ref 1) in one particular: instead of two samples on the gonometer table a cryostat was used with one sample in it. Fig 1 shows the external view of the apparatus. The following details are marked in Fig 1: the slit (S) of a monochromator ZMR-2, a polarizer P and an analyser A, the cryostat K and a receiver B (a photoresistor or a bolometer). The polarizer and analyser consisted each of a pile of selenium plates which had to be replaced every 3-4 months. Details of the cryostat are shown schematically in Fig 2. Measurements were made at 290 and $110^{\circ}K$ (using liquid oxygen in the jacket of the cryostat). The apparatus had to be adjusted very carefully in order to avoid serious errors: first the selenium piles were adjusted and then the sample. Measurements were made on four samples; the values of the optical constants of the individual sample differed by no more than 5-8%. Control measurements, carried out using other methods (Ref 5), gave similar results. Fig 3 shows the refractive (curves a) and absorption (curves 6) indices of antimony as a function of wavelength between 1 and 12 μ at temperatures of 290 (curves 1a, 16) and $110^{\circ}K$

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Measurements of the Optical Constants of Antimony in the Infrared Spectral Region at Temperatures of 290 and 110°K

(curves 2a, 2б). The same figure contains the values of μ and $\mu\chi$ of antimony, obtained at room temperature and 2.45 μ wavelength, by Domanskiy and Noskov (Ref 6); these are shown as points 3a and 3б. From the mean values of the optical constants the authors constructed the wavelength dependence of the real $\left[\mu^2 - (\mu\chi)^2\right]$ and imaginary $\left[2\mu(\mu\chi)\right]$ components of complex permittivity; this is shown in Fig 4. Fig 5 shows the wavelength dependence of the absorption coefficient A calculated from

$$A = 4\mu/\left[(\mu + 1)^2 + (\mu\chi)^2\right].$$

The $A = f(\lambda)$ curves exhibit clear maxima which are due to interband transitions. From the positions of the maxima on the A curves the interband energy gap was calculated. It was found to be 0.18 eV at room temperature and 0.15 eV at 110°K. This compares well with the

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Measurements of the Optical Constants of Antimony in the Infrared Spectral Region at Temperatures of 290 and 110°K

values of 0.05 to 0.20 eV at room temperature reported by Smith (Ref 7). Acknowledgment is made to K.D. Sinel'nikov for his advice. There are 5 figures and 7 references, 5 of which are Soviet and 2 English.

SUBMITTED: May 19, 1958

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SOV/51-6-5-19/34

24(4)
AUTHORS: Shklyarevskiy, I.N. and Avdeyenko, A.A.

TITLE: Reduction of Reflection of Metallic Coatings (Prosvetleniye
metallicheskikh pokrytiy)

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 5, pp 678-684 (USSR)

ABSTRACT: It is very desirable to reduce reflection at the glass-metal boundary
in the Fabry-Perot interferometer plates, keeping the reflectivity at
the air-metal boundary unchanged.   This would improve transmission of
the plates and consequently increase their speed, contrast and resolving
power.   Such a reduction can be achieved by evaporating a thin film
(100-150 Å) of silver on a glass plate heated to 300-400°C and then
depositing the main aluminium layer.   Transmission of semi-transparent
aluminium coatings on glass pre-treated in this way is increased by a
factor of 2 to 4 in the wavelength region 600-1100 mµ (Fig 5).
Transmission of semi-transparent coatings of silver can be improved
by a factor of 1.5 to 2.8 when these coatings are deposited on glass
plates previously covered with 100-150 Å silver films (deposited at
300-400°C) on top of which very thin aluminium layers were evaporated
(Fig 7).   Reduction of reflection of interferometer plates produces
a reversal of interference lines (Fig 8).   The intensities of the
reverse lines are higher than the intensities of lines reversed by

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SOV/51-6-5-19/34

Reduction of Reflection of Metallic Coatings

cutting out the "zero-order" lines. This makes it possible to use reflection interferometers with a second opaque coating in studies of hyperfine structure. One section of the paper deals with the optical properties of thin silver films deposited on glass plates heated to 100, 200, 300 and 400°C. The optical constants of such films were found to be similar to the constants recorded earlier for thick silver layers deposited on hot substrates. These films are granular in structure as shown in Fig 2. Acknowledgment is made to K.D. Sinel'nikov for his advice. There are 8 figures and 13 references, 8 of which are Soviet, 3 German, 1 English and 1 translation from English into Russian.

SUBMITTED: November 10, 1958

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SOV/51-6-6-9/34

24(4), 24(3)

AUTHORS: Shklyarevskiy, I.N. and Padalka, V.G.

TITLE: The Anomalous Skin-Effect and the Optical Constants of Copper, Silver, Gold and Nickol in the Infrared Region (Anomal'nyy skin-effekt i opticheskiye postoyannyye medi, serebra, zolota i nikelya 7 infrakrasnoy oblasti spektra)

PERIODICAL: Optika i spektroskopiya, 1959, Vol 6, Nr 6, pp 776-779 (USSR)

ABSTRACT: Recently the authors measured the optical constants of copper, silver, gold and nickel at infrared wavelengths and interpreted their results in terms of the classical free-electron theory of Drude (Refs 1, 2). From these optical constants the authors had deduced, inter alia, the d.c. electrical conductivities of these metals.   These conductivities were found to be considerably smaller than the values obtained directly on massive samples.   The reason for this discrepancy lies in the use of dispersion formulae of Drude which are valid only for the normal skin-effect, when the inequality $l \ll \delta$ is satisfied (l is the mean free path of electrons and δ is the depth of the "skin" layer). For good conductors at room temperature the mean free path of electrons may be of the order of the depth of the skin layer, and at low temperatures this path may be considerably larger than δ, i.e. anomalous skin-effect

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The Anomalous Skin-Effect and the Optical Constants of Copper, Silver, Gold and Nickel in the Infrared Region

conditions apply. Dingle (Refs 4-6) gave the theory of the anomalous skin effect and derived the dispersion formulae for the optical constants of metals in the infrared region. Dingle allowed for the fact that electrons can be reflected from the metal surface both specularly and diffusely. His theory involves a coefficient of specularity p; $p = 1$ for specular reflection and $p = 0$ for diffuse reflection. In real metals p lies between 1 and 0. The authors used Dingle's theory and the values of the optical constants of copper, silver, gold and nickel, determined earlier, (Refs 1, 2), to calculate the conduction electron densities N, the relaxation times τ and the values of $(1 - p)v$ for these metals (here v is the electron velocity at the Fermi surface). All these quantities are listed in the table on p 779, cols 5, 6 and 8 respectively. These calculations were made on the assumption that the electrical conductivity of thick metal films deposited in vacuo is equal to the conductivity of massive samples. Acknowledgment is made to K.D. Sinel'nikov for his advice. There are 3 figures, 1 table and 8 references, 4 of which are Soviet, 3 English and 1 translation from English into Russian.

SUBMITTED: November 26, 1958

Card 2/2

24(4)

AUTHOR: Sklyarevskiy, I.N.

TITLE: A New Interferometric Method of Measuring Dispersion of Liquids (Novyy interferometricheskiy metod izmereniya dispersii zhidkostey)

ABSTRACT: The author et al had already described an interferometric method of measuring dispersion of liquids and solids (films) in the visible (Ref 1) and ultraviolet (Ref 2) regions. It was shown (Refs 1-3) that, although the method has the advantage of high speed compared with the method described by Obreimov (Ref 4), it was not very accurate because the phase shift at the dielectric-metal boundary was neglected. The present paper describes a modified method which does not have this disadvantage. The effect of dispersion of the phase shift is allowed for in the same way as in measurement of thickness of thin films (Ref 5). One of the inter- ferometer plates is polished in such a way as to form a step of 2-3 thickness (Fig 1a). The second plate is an optical flat. The internal surfaces of the two plates are covered by semi-transparent layers of silver or aluminium (the latter is used for measurements in the ultra- violet region). The metal coating on the plate with the step is ruled in several places (Fig 1d). The scratches P so formed are used later as

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A New Interferometric Method of Measuring Dispersion of Liquids   SOV/51-6-6-10/34

the datum marks. The two plates are pressed against each other and placed in front of a spectrograph slit, as shown in Fig 2. In the focal plane of the objective of the spectrograph camera two systems of equal-chromatic order lines are observed; they are due to the two different thicknesses of the air gaps t_1 and t_2, shown in Fig 1a. The plates are placed on an object table and are moved in a horizontal direction parallel to the plane of the spectrograph slit. When one of the scratches P is focused on the slit, the interference pattern disappears. When this happens the reading of the drum of the micrometer screw of the object table is noted and in this way two or three positions of the scratch marks are recorded. The height of the step is determined exactly at several places between the scratches. This height is deduced from

$$t = (m - n)(\lambda/2),$$

where λ is the wavelength at which two interference lines of order m and n (one from each system) coincide (Ref 7). Since the wavelength can be found to within 0.1 Å, the step height may be also determined with the same accuracy. To find dispersion of a liquid it is placed in the gap between the interference plates, and the interference pattern is recorded for one of the places where the step height t is known exactly. The refractive index of the liquid is deduced from the difference between

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the ordinates of the following two curves: $m\lambda/2t = f(\lambda)$ and $n\lambda/2t = \varphi(\lambda)$. Such a procedure excludes the effect of the dispersion of the phase shift at the dielectric-metal boundary. The order of interference is determined as follows. Let λ_0 and λ_1 be the wavelengths of two neighbouring lines. If the corresponding refractive indices of the liquid μ_0 and μ_1 do not differ too much, then

$$m = \lambda_1/(\lambda_0 - \lambda_1).$$

The value of m should be rounded out to the nearest integer. The true order of interference is equal to $(m - 1)$, as shown in Ref 3. The method described above is suitable also for measurements in the ultraviolet region. In this case the source may be an iron arc or spark. The experimental technique for this case has already been described (Ref 2). G.M. Polyakova and S.T. Verkhovtseva took part in experiments designed to try out the method described above. Acknowledgment is made to K.D. Sinel'nikov for his advice. There are 3 figures and 6 Soviet references.

SUBMITTED: December 26, 1958.

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SOV/51-7-4-23/32

AUTHORS: Shklyarevskiy, I.N., Verkhovtseva, E.T. and Polyakova, G.N.

TITLE: On the "Vernier Effect" Observed when the Thickness of Thick Layers is Measured Using an Interferometric Method.

PERIODICAL: Optika i spektroskopiya, 1959, Vol 7, Nr 4, pp 566-568 (USSR)

ABSTRACT: In a preceding paper Shklyarevskiy (Ref 1) described an interferometric method of measuring thickness of thin and thick films.   Two plates were used, distance t_1 apart.   A layer of thickness t deposited on, say, one half of one of the plates, reduced the air gap locally to t_2, i.e. $t = t_1 - t_2$.   If these plates were placed in front of a spectrograph slit and illuminated with a parallel beam of white light, then two systems of equal-chromatic-order lines were observed in the focal plane of the spectrograph camera.   By selecting the air gaps t_1 and t_2 it was possible to make one line of m-th order of one system to coincide with an n-th order line of the second system.   The wavelength λ_0 of the coincident lines and their interference orders determine the layer thickness: (1)
$$t = (m - n)\lambda_0/2.$$
This formula is independent of the phase shifts (Ref 1).   A new coincidence between lines of the equal-chromatic-order systems should

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On the "Vernier Effect" Observed when the Thickness of Thick Layers is Measured
Using an Interferometric Method

occur after k lines of one system and (k + 1) lines of the second
system, i.e. the so-called vernier effect should be observed. The authors
show that the exact vernier effect would be possible only if the
dispersion of the phase shift was absent. If such dispersion occurs
exact coincidence of more than one pair of lines is impossible. When
not even one pair of lines is coincident on an interferogram, the
film thickness can be calculated using

$$t = t_1 - t_2 = \frac{m\lambda_0}{2} - \frac{n\lambda_0'}{2} , \qquad (10)$$

where n and m are the orders and λ_0, λ_0' are the wavelengths of the two
lines which almost coincide. Neglect of the phase shifts in Eq (10)
leads to an error in the fifth place. This is unimportant in measurement
of thicknesses of the order of several microns as shown by the practical
example of a ZnS layer whose interferogram is given in a figure on p 568.
The wavelengths and the interference orders of the almost coincident lines

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On the "Vernier Effect" Observed when the Thickness of Thick Layers is Measured
Using an Interferometric Method

shown in the figure, are listed in a table on p 568. The mean thickness
of the ZnS layer, calculated using Eq (10) was 49998.45 Å, which differs
only slightly from 50 000.2 Å calculated using Eq (1) for the
$\lambda = 5263.18$ Å. Acknowledgment is made to K.D. Sinel'nikov for his
advice. There are 1 figure, 1 table and 5 references, 2 of which are
Soviet, 2 English and 1 translation from English into Russian.

SUBMITTED: March 27, 1959

Card 3/3

SIMEL'NIKOV, L.D.; SHILYAREVSKIY, I.N.; GUDKOVA, I.V.

Colors of wrinkled transparent films on metal surfaces. Opt.
i spektr. 7 no. 6:846-848 D '59.
(MIRA 14:2)
(Films (Chemistry))

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TITLE: A Photographic Method of Measuring Optical Constants of
          Metals

PERIODICAL: Optika i spektroskopiya, 1960, Vol 8, Nr 2,
          pp 239 - 242 (USSR)

ABSTRACT: The paper describes a photographic method of measuring
          optical constants of metals in the visible and ultra-
          violet regions. This method is a modification (in
          experimental technique and in calculations) of the
          Shklyarevskiy et al polarization method of measuring
          optical constants of metals in the visible (Ref 1)
          and infrared (Refs 2,3) regions, based on the use of
          multiple reflection of light from two parallel identical
          samples. The apparatus used is shown schematically in
          Figure 1. Whie light from a source O proceeds via an
          achromatic lens L_1 and a polarizer P to reach a
          sample (2) from which it is reflected to another
          sample (1) . Several such reflections occur between
          the two samples and then the light proceeds via an analyser

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A , another achromatic lens L_2 to a spectrograph slit S . By suitable selection of the angle of incidence on the samples φ' one can find a certain wavelength λ' for which the phase difference $m\Delta$ after m reflections from the samples will be $-180\ ^{\circ}C$. The wavelength λ' is extinguished by a suitable rotation of the analyser and the value of λ' is found by comparing the extinguished band (line) with a calibration spectrum. The procedure is repeated for a different angle of incidence φ'' and a corresponding wavelength λ'' is found. In this way we can construct a curve representing $\varphi = f_1(\lambda)$ for $\Delta_1 = -60^{\circ}$ (triple reflection, m = 3) . Similarly, a curve representing $\varphi = f_2(\lambda)$ can be constructed for five-fold reflection, when $\Delta_2 = -36^{\circ}$. Using these two curves we can find, for any given wavelength, two pairs of values:

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φ_1, $A_1 = -60^o$ and φ_2, $\Delta_2 = -36^o$. The refractive index μ and the absorption index $\mu\chi$ are given by:

$$\mu = \left[\frac{1}{2}(a^2 - b^2 + \sin^2\varphi) + \frac{1}{2}\sqrt{(a^2 - b^2 + \sin^2\varphi)^2 + 4a^2b^2}\right]^{1/2}$$

$$\mu\chi = \left[-\frac{1}{2}(a^2 - b^2 + \sin^2\varphi) + \frac{1}{2}\sqrt{(a^2 - b^2 + \sin^2\varphi)^2 + 4a^2b^2}\right]^{1/2}$$

(3)

where:

$$b = \frac{tg\,\Delta_1\,tg\,\Delta_2(\sin^2\varphi_1\,tg^2\varphi_1 - \sin^2\varphi_2\,tg^2\varphi_2)}{2(tg\,\Delta_2\sin\varphi_1\,tg\,\varphi_1 - tg\,\Delta_1\sin\varphi_2\,tg\,\varphi_2)}$$

(4)

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$$a = \sqrt{\sin^2\varphi_1 \, tg^2\varphi_1 - b^2 - 2b.ctg\,\Delta_1\sin\varphi_1\,tg\,\varphi_1} \qquad (5)$$

and

$$\sin^2\varphi = \frac{1}{2}(\sin^2\varphi_1 + \sin^2\varphi_2) \qquad . \qquad\qquad (6)$$

If $\sin^2\varphi_1 \approx \sin^2\varphi_2 \ll \left|\mu^2 - (\mu\chi)^2\right|$, then $\mu = a$ and $\mu\chi = b$. The optical constants can be found also graphically. To check the method suggested the authors measured the optical constants of antimony in the visible region of the spectrum. The following values were obtained:

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$\lambda = 650$ mμ $\mu = 2.69$ $\mu\chi = 3.92$

$= 600$ $= 2.31$ $= 3.89$
$= 550$ $= 2.01$ $= 3.69$
$= 500$ $= 1.75$ $= 3.44$
$= 450$ $= 1.46$ $= 3.14$.

The authors measured also the optical constants of antimony using the original unmodified polarization method (Ref 1) and found that these constants agreed with the values quoted above. The optical constants of antimony obtained by the authors differ somewhat from those reported by Quincke (Ref 7). N. Ya. Seraya and L. Ya. Seraya took part in measurements of the optical constants of antimony. Acknowledgment is expressed to K.D. Sinel'nikov for his advice. There are 2 figures and 8 references, 5 of which are Soviet and 3 German.

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AUTHORS: Padalka, V.G. and Shklyarevskiy, I.N.

TITLE: A Contribution to the Technique of Measurements of the Optical
              Constants of Metals at Low Temperatures

PERIODICAL: Optika i spektroskopiya, 1960, Vol 9, Nr 1, pp 119-121 (USSR)

ABSTRACT: The authors describe a cryostat suitable for low-temperature
              measurements of the optical constants of metals, using one of the
              published polarization methods (Refs 2-6). The cryostat is in
              the form of a copper cylinder, fitted with windows. Samples are
              placed in this cylinder in such a way that they are in good
              contact with copper reservoirs in which liquid nitrogen is
              circulated. The sample positions can be adjusted from outside
              and the cryostat can be evacuated down to 5×10^{-5} mm Hg. Two
              cross-sections through the cryostat are shown in Fig 1 and its
              photograph is given in Fig 2. There are 2 figures and 9 references,
              7 of which are Soviet and 2 English.

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SHKLYAREVSKIY, I.N.; VLASENKO, N.A.; M.LOSLAVSKIY, V.K.; NOSULENKO, N.A.

Value and sign of the phase difference $\Delta = \delta_p - \delta_s$. Opt. i spektr.
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